NASA Research on Integrating Weather into ATM Decisions

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February 12, 2008
NextGen Conference on Integrating Weather, Airports, and Air Navigation Services

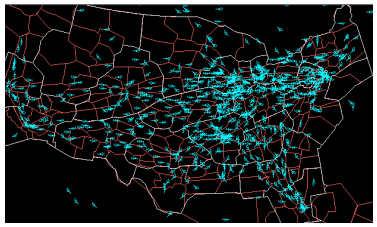
Aeronautics Programs

Fundamental Aeronautics Program

Conduct cutting-edge research that will produce innovative concepts, tools, and technologies to enable revolutionary changes for vehicles that fly in all speed regimes.

Aviation Safety Program

Conduct cutting-edge research that will produce innovative concepts, tools, and technologies to improve the intrinsic safety attributes of current and future aircraft.



Airspace Systems Program

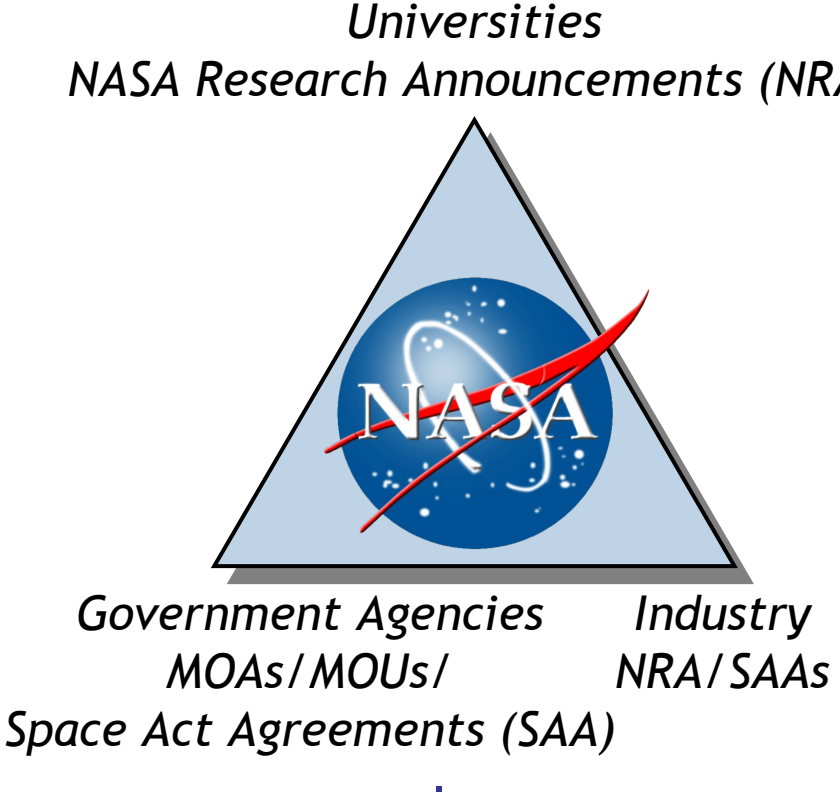
Directly address the fundamental ATM research needs for NextGen by developing revolutionary concepts, capabilities, and technologies that will enable significant increases in the capacity, efficiency and flexibility of the NAS.

Background

- Until recently, limited NASA R&D was directed toward integration of weather information into ATM decision support tools
- A key finding from an Airspace Systems technical meeting, held in 2007 and attended by 158 NASA and non-NASA participants, was the requirement to emphasize off-nominal situations
- This year, we established partnerships and solicited research to better address weather integration in ATM decisions

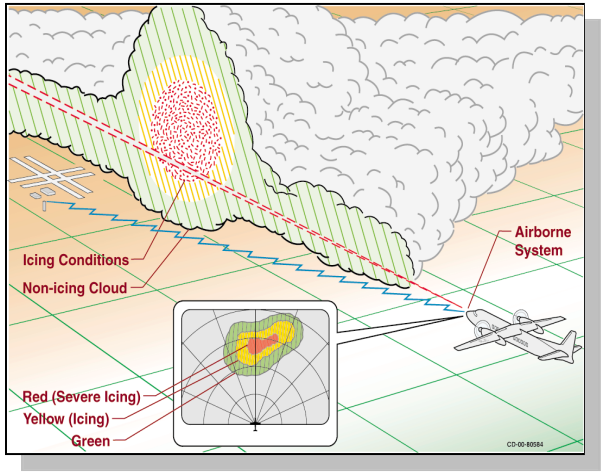
Partnering Philosophy

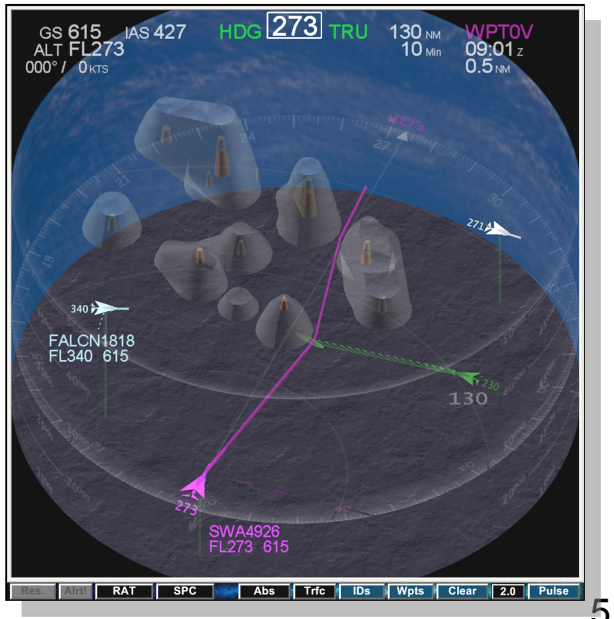
- To enhance the state of Aeronautics for the Nation
- To leverage opportunities that would not be available otherwise
- To maintain a thriving Aeronautics workforce
- To provide help and expertise to, and learn from, other government agencies
- To provide for long-term stability of foundational research
- Ultimately, to maximize the return on investment to the taxpayer (our main stakeholder)



Integrated Intelligent Flight Deck

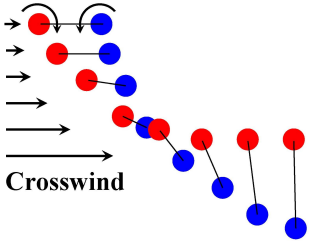
- Forward-looking sensors
  - Advanced radar capabilities
  - Lidar/electro-optical applications
  - Interferometric techniques
  - Image processing & feature extraction
  - Current foci: turbulence, icing, runway hazards
  - Observations can be transmitted to others
- Decision-support and display concepts
  - User requirements for content and quality of Wx product (e.g. RTCA SC-206 AIS/MET services)
  - Integrated display concepts (e.g. Nav, comm, traffic, wx, terrain, airspace)
  - External hazard monitor function: Integrates all onboard observations with datalink info, aircraft state, and context to support robust caution/warning advisories



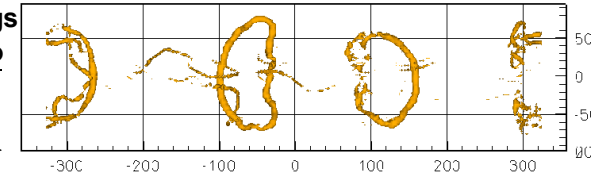


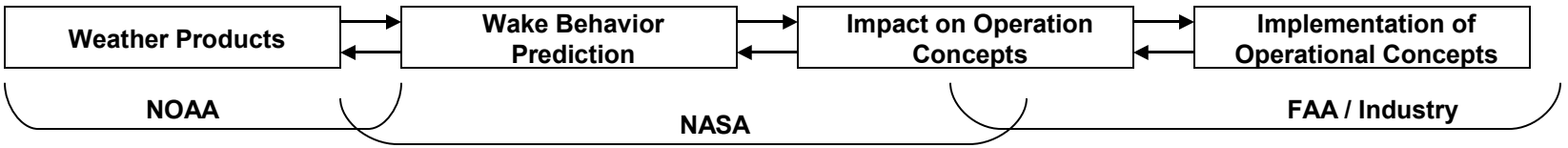
NextGen-Airportal

- Airport operations are constrained by uncertainty in aircraft wake vortex behavior (decay and motion)
  - Separation criteria for single and multiple runway operations
  - Potential for greater wake impact under envisioned automation of 4D trajectories
- Wake behavior prediction places unique requirements on weather products
  - Product types, fine grids, probabilistic products
- NASA is working the multi-disciplinary interface between operational concepts and weather requirements
  - Wake vortex physics and decay/motion prediction
  - Sensitivity of capacity-increasing concepts to wake vortex
  - Sensitivity of wake behavior prediction to atmospheric parameters



Vortex Rings
Photo
CFD

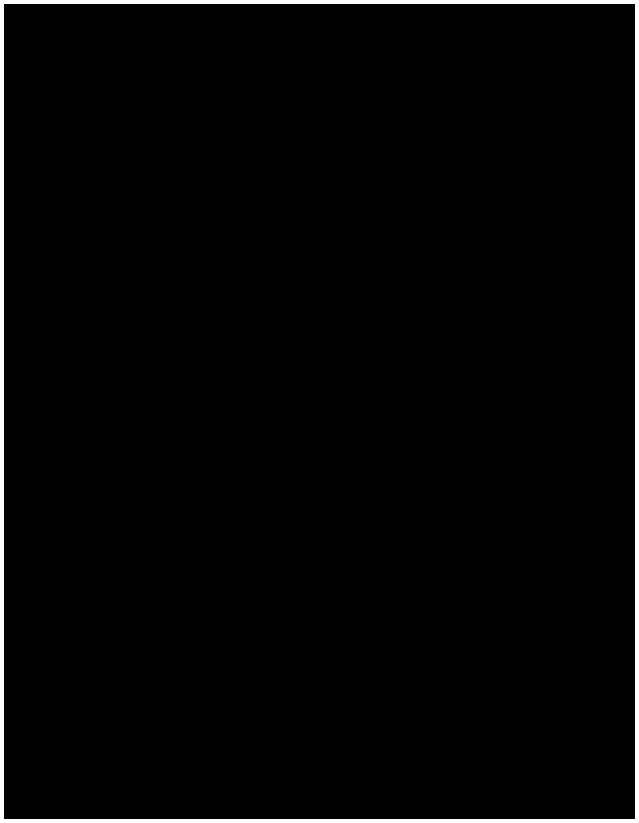




NextGen-Airspace

- Weather-related topics are embedded in research focus areas
  - Traffic flow management
  - Trajectory prediction, synthesis and uncertainty
  - Super density operations
- Fundamental questions include:
  - How can we translate meteorological information to ATM impacts ?
  - How can we improve tactical and strategic ATM decision making using weather observations and forecasts ?
  - What weather information do we need for ATM decision algorithms in NextGen?

Concluding Remarks



- National Plan for Aeronautics R&D and Related Infrastructure Plan (Dec. 2007)
  - One Mobility goal is to “reduce the adverse impacts of weather on ATM decisions”
- NASA research contributes to objectives of this goal
  - Defining accuracy requirements for weather forecasting
  - Understanding how to use probabilistic weather data and uncertainty
- Progress on long-term R&D for NextGen will be discussed at the Airspace Systems Program Technical Interchange Meeting in March 2008 (see http://www.aeronautics.nasa.gov)